

Design and Performance of a 2.7 THz Waveguide Tripler

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ABSTRACT

The authors present the detailed design and performance of an 850 to 2550 GHz waveguide tripler incorporating planar MOMED (monolithic membrane diode) devices. The waveguide mount (Fig. 1) employs an unusual split-block configuration which allows the waveguides to lie parallel to one another (inline input and output) but contain replaceable backshort tuning elements behind each of the integrated dual mode feed horns. The diode and RF filter structures are formed wholly on a 3 micron thick by 20 micron wide GaAs membrane bridge which spans the faces of the input and output waveguides (Fig. 2). Beam lead shorting bars are formed both on the GaAs membrane support frame as well as on the membrane itself to allow close in matching of the diodes. Single submicron diodes as well as, for the first time, planar antiparallel pair devices, have been formed together on the membrane. The antiparallel-pair configuration allows odd harmonic multiplication. In order to be able to optimize independently both the input and output circuits, replaceable backshort cavities were incorporated into the design. Extensive use of a precision NC controlled milling machine was used to form the waveguide and filter cavities. Semi-circular sided waveguide was utilized throughout to allow direct machining of the waveguide tuner cavities and simplify fabrication.

For testing purposes a strong (>100W) CO₂ laser was used to generate sufficient FIR power at fundamental frequencies of 790 and 850 GHz. The tripled output power was measured with an uncalibrated Helium cooled Si-bolometer. At 850 GHz, with approximately 6 mW of input power, 0.1 μ W of output was detected at 2.55 THz. At 787 GHz the data shown in Fig. 3 was measured with 7-8 mW input.

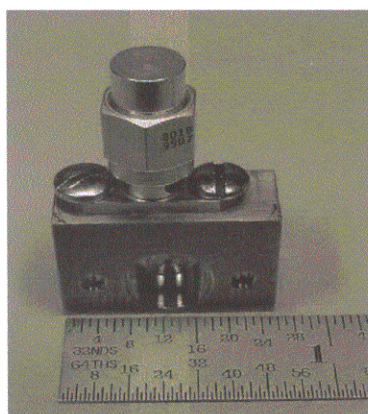


Fig. 1: Photograph of the assembled MOMED tripler.

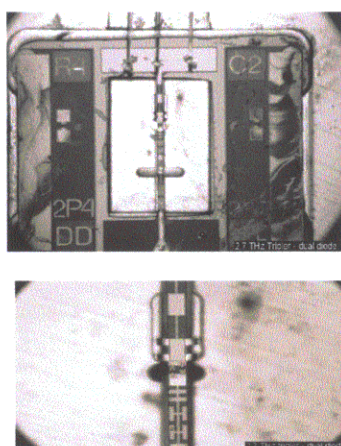


Fig. 2.: Top: Mounted MOMED circuit. Bottom: Close up of diode and output waveguide.

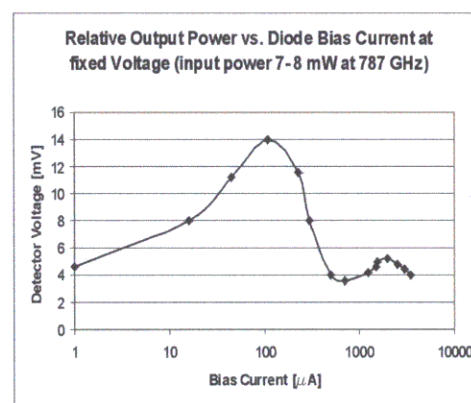


Fig. 3: Measured output power (detector voltage) versus diode bias current at 2361 GHz at a fixed input power of approx. 7mW.